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TITLE: **SPACE DIVERSITY ANTENNA INSTALLATION** SYSTEM AND MOBILE COMMUNICATION EQUIPMENT USING IT

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APPL-DATE: January 25, 1996

INT-CL (IPC): H04B007/02

ABSTRACT:

PROBLEM TO BE SOLVED: To receive a signal with excellent transmission quality by calculating a correlation value for each interval of antennas used for a parameter and selecting an antenna interval minimizing the correlation value.

SOLUTION: A correlation calculation section 8 of a radio equipment terminal 3 calculates a correlation value from a reception signal from each antenna (each branch), a correlation comparator section 9 compares the obtained correlation values to select a minimum correlation value and an interval control section 10 controls a movement of the antenna by using the antenna interval as a parameter and a buzzer section 11 and a display section 12 inform that the movement of the antenna is finished. In this case, an antenna moving device 4 is connected to reception antennas 1, 2 to move them according to the interval control section 10. Furthermore, the antenna moving device 4 is mounted onto a roof of a mobile radio vehicle 15. Moreover, a vehicle position detector 14 to obtain vehicle position data and a database 13 storing the data and the interval data are provided to the outside of the radio equipment.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a space diversity antenna installation configuration.
[0002]
[Description of the Prior Art] In order to mitigate the effect of phasing and to realize high quality transmission conventionally, space diversity antenna system is used. Two or more antennas are used for this method, and it sets and installs suitable spacing so that the correlation of the receiving level between each antenna may decrease.
[0003] Usually, the approach of carrying out fixed installation at intervals of the arbitration defined beforehand from the approach of carrying out fixed installation at spacing which the carrier frequency detached the half-wave length grade and an operating frequency, a wireless circuit situation, etc. is used for the installation approach of space diversity antenna system.
[0004]
[Problem(s) to be Solved by the Invention] Since spacing of an antenna was immobilization, the conventional installation configuration mentioned above had the fault that correlation arose on mutual receiving level and the good transmission quality could not be realized under the effect of fluctuation of the phasing environment of a wireless circuit regarding the place etc. when suitable spacing changes.
[0005]
[Means for Solving the Problem] The description of this invention prepares the correlation count section which calculates the mutual correlation value of the input signal according to individual by which antenna spacing makes a parameter the antenna migration equipment and antenna spacing which can carry out adjustable, and is received for two or more receiving antennas of every in order to solve the above-mentioned technical problem, and installs it at intervals of the antenna to receive and which becomes the closest to no correlating for every area. Moreover, in the area which asked for spacing once, you make it the car location detection equipment currently mounted interlocked with, and spacing data are memorized in the database with car location data, and again, when receiving in this area, spacing data are obtained from a direct database with the car location data of car location detection equipment.
[0006] In this invention, since it can install at intervals of the antenna which was adapted for fluctuation regarding the place by preparing antenna migration equipment and the correlation count section like the above, it becomes possible to receive with the good transmission quality. Moreover, since spacing data are storable in a database with car location data by making it car location detection equipment interlocked with, when receiving again in the area, antenna migration can be performed promptly.
[0007]
[Embodiment of the Invention] One example of this invention is explained using drawing 1 and drawing 2 . This example is the case where two receiving antennas are used. First, configuration block drawing is shown in drawing 1 . The correlation count section 8 which calculates a correlation value from the input signal from each antenna (each branch), the correlation comparator 9 which compares the calculated correlation value

and chooses so-called min, the spacing control section 10 which controls migration of an antenna by making antenna spacing into a parameter, the buzzer section 11 which reports that antenna migration was completed, and the display display 12 are formed in the walkie-talkie terminal 3. Antenna migration equipment 4 is connected to receiving antennas 1 and 2, and it moves to them according to the spacing control section 10. In antenna migration equipment 4, as shown in image drawing shown in drawing 3, it is carried on the roof of the mobile radio vehicle 15. The database 13 which stores the car location detection equipment 14, and its data and spacing data for obtaining car location data is formed in the wireless section outside the plane.

[0008] Drawing 2 is a flow of operation in this example. First, before [, such as the time of power-source starting] starting a communication link, car location data are obtained with car location detection equipment 14 (step 100). Next, the antenna spacing data to this data judge whether it is stored in the database 13 (step 101). When data are stored, spacing data are sent out to the spacing control section 10, the control signal over the data is sent out to antenna migration equipment 4, and antennas 1 and 2 are moved (step 105). adjusted Finally, the buzzer section 11 and the display display 12 report the completion of antenna migration (step 106).

[0009] Next, when spacing data are not stored, it asks for spacing data in the following actuation. Spacing data are memorized as a parameter for correlation value count in the movable range in spacing by the spacing control section 10. First, according to one spacing data, antenna migration is performed from this spacing control section 10. Next, reception is started, a correlation value is calculated from the signal level of an intermediate frequency signal in the correlation count section from a received higher harmonic wave and the intermediate frequency sections 5 and 6 (step 102), and this is memorized to the correlation comparator 9. About another spacing data, a correlation value is calculated similarly. The calculated correlation value chooses and memorizes the smaller one as compared with the correlation value memorized last time in the correlation comparator 9 (step 103). This actuation is repeated about all range and performed. Here, antenna spacing to the correlation value eventually memorized to the correlation comparator 9 is the optimal spacing in a local region. Therefore, the spacing data to the memorized correlation value are read from the spacing control section 9, and it memorizes in the database 13 with the car location data from car location detection equipment 14 (step 104), and when communicating from next time in this area, this spacing data is referred to. Finally, antennas 1 and 2 are moved according to spacing data (step 105), and the buzzer section 11 and the display display 12 report completion (step 106).

[0010]

[Effect of the Invention] According to this invention, as explained above, a correlation value is calculated for every spacing by making antenna spacing into a parameter, since it constituted so that antenna spacing from which a correlation value serves as min might be chosen, for every every place region, the optimal antenna spacing according to fluctuation of the phasing environment of a wireless circuit regarding the place is obtained, and the always optimal digital error rate can be held. Moreover, with the car location data detected with car location detection equipment, since the data obtained by doing in this way were constituted so that it might memorize in a database, they can set up optimal antenna spacing immediately and high-speed control is very possible for them

in the area which calculated the once correlation value. Therefore, the employment area of a mobile station is suitable for especially this invention in the migration communication system for self-management limited in the specific area.

Claim(s)]
[Claim 1] In the installation configuration of the space diversity antenna used for a mobile station walkie-talkie, in order to hold a communicative digital error rate good for every every place region The control means which makes the optimal spacing control spacing between two or more antennas is provided. This control means The antenna migration means which can carry out adjustable setting out of the spacing between two or more above-mentioned antennas, a correlation value count means to compute the mutual correlation value of the input signal which makes spacing between the above-mentioned antennas a parameter, and is received for every antenna, The space diversity antenna installation configuration characterized by having a correlation value comparison means to choose the minimum correlation value from each computed this correlation value, and the control means which makes the above-mentioned antenna migration means control so that the above-mentioned correlation value serves as min.
[Claim 2] It is the diversity antenna installation configuration characterized by to constitute so that the optimal antenna spacing value in mobile station location data and its location may be stored in this database as data and spacing between the above-mentioned receiving antennas may be controlled at the optimal spacing with reference to these data for every every place region including the location detection means and the database with which the above-mentioned control means detects the location of a mobile station in a space-diversity antenna installation configuration according to claim 1.
[Claim 3] The mobile station location data referred to for every every place region in a space diversity antenna installation configuration according to claim 2 are a space diversity antenna installation configuration characterized by constituting so that it may obtain from the detection equipment which receives the electric wave of a satellite, a beacon, etc. and detects a mobile station location.
[Claim 4] The migration communication device using a space diversity antenna installation configuration given in claims 1, 2, and 3.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since spacing of an antenna was immobilization, the conventional installation configuration mentioned above had the fault that correlation arose on mutual receiving level and the good transmission quality could not be realized under the effect of fluctuation of the phasing environment of a wireless circuit regarding the place etc. when suitable spacing changes.

MEANS

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for two or more receiving antennas of every in order to solve the above-mentioned technical problem, and installs it at intervals of the antenna to receive and which becomes the closest to no correlating for every area. Moreover, in the area which asked for spacing once, you make it the car location detection equipment currently mounted interlocked with, and spacing data are memorized in the database with car location data, and again, when receiving in this area, spacing data are obtained from a direct database with the car location data of car location detection equipment.

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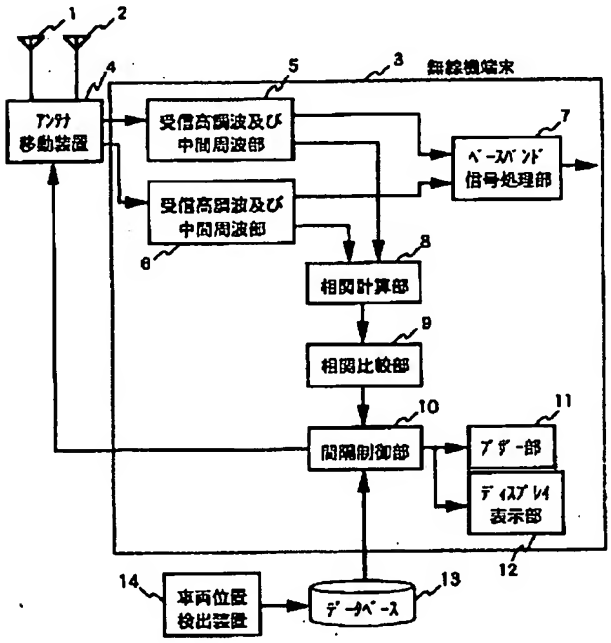
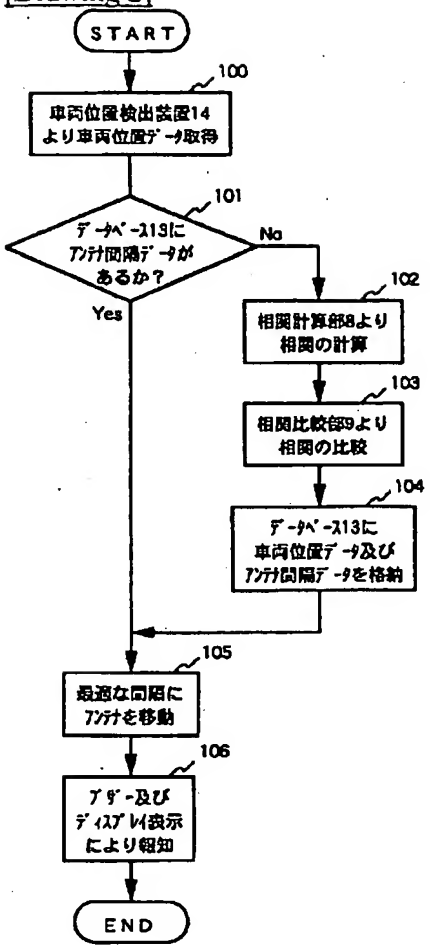


[Drawing 3]

[Drawing 2]


START
100
車両位置検出装置14
より車両位置データ取得
101
データベース13に
アンテナ間隔データが
あるか？
No
Yes
102
相関計算部8より
相関の計算
103
相関比較部9より
相関の比較
104
データベース13に
車両位置データ及び
アンテナ間隔データを格納
105
最適な間隔に
アンテナを移動
106
ブザー及び
ディスプレイ表示
により報知
END

APP 10/528,097
KAMRAN AFSHAR

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Ｈ０４Ｂ　7/02			Ｈ０４Ｂ　7/02	Ａ

審査請求　未請求　請求項の数４　ＯＬ　（全４頁）

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(22)出願日　平成８年(1996)１月25日

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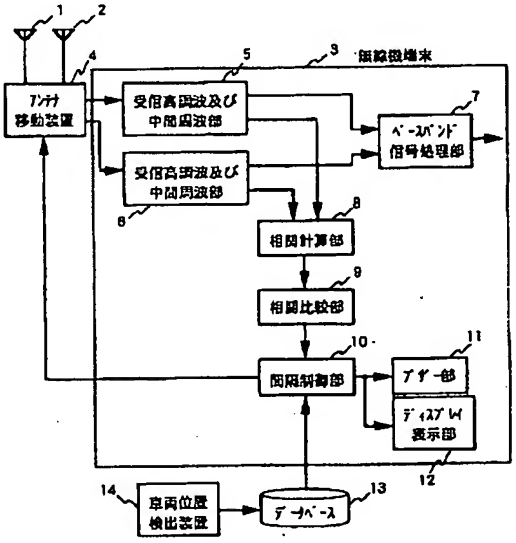
(54)【発明の名称】　空間ダイバーシチアンテナ設置方式及びそれを用いた移動通信装置

(57)【要約】
【課題】　車載用無線機に用いられる空間ダイバーシチアンテナの設置方式において、地域毎にアンテナの間隔を定めて設置することにより、場所的変動に対して良好な伝送品質で通信が行える空間ダイバーシチアンテナ設置方式を提供することを目的とする。
【解決手段】　受信部にアンテナ移動装置と相関計算部及び相関比較部を設け、地域毎にアンテナ間隔をパラメータとして相関値を計算比較して相関値が最小となる間隔で設置するまたは、地域毎に間隔をデータベースに格納しておき、それを参照して設置する空間ダイバーシチアンテナ設置方式。



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【特許請求の範囲】
【請求項１】　移動局無線機に用いられる空間ダイバーシチアンテナの設置方式において、
各地域毎に通信の符号誤り率を良好に保持するために、複数のアンテナ間の間隔を最適な間隔に制御せしめる制御手段を具備し、
該制御手段は、上記複数のアンテナ間の間隔を可変設定できるアンテナ移動手段、上記アンテナ間の間隔をパラメータにして各アンテナ毎に受信される受信信号の互いの相関値を算出する相関値計算手段、該算出した個々の相関値から最小の相関値を選択する相関値比較手段、上記相関値が最小となるように上記アンテナ移動手段を制御せしめる制御手段を備えることを特徴とする空間ダイバーシチアンテナ設置方式。
【請求項２】　請求項１に記載の空間ダイバーシチアンテナ設置方式において、
上記制御手段は、移動局の位置を検出する位置検出手段とデータベースとを含み、該データベースに、移動局位置データとその位置における最適なアンテナ間隔値をデータとして格納しておき、各地域毎に該データを参照して上記受信アンテナ間の間隔を最適な間隔に制御するように構成したことを特徴とするダイバーシチアンテナ設置方式。
【請求項３】　請求項２に記載の空間ダイバーシチアンテナ設置方式において、
各地域毎に参照する移動局位置データは、人工衛星、ビーコン等の電波を受信して移動局位置を検出する検出装置から得るように構成したことを特徴とする空間ダイバーシチアンテナ設置方式。
【請求項４】　請求項１，２，３に記載の空間ダイバーシチアンテナ設置方式を用いた移動通信装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、空間ダイバーシチアンテナ設置方式に関するものである。
【０００２】
【従来の技術】従来、フェージングの影響を軽減し高品質伝送を実現するために、空間ダイバーシチアンテナ方式が用いられている。この方式は、複数のアンテナを使用し、各アンテナ間における受信レベルの相関関係が低減するように、適当な間隔をおいて設置する。
【０００３】通常、空間ダイバーシチアンテナ方式の設置方法には、キャリア周波数の半波長程度離した間隔で固定設置する方法、及び使用周波数、無線回線状況等から、あらかじめ定められた任意の間隔で固定設置する方法等が用いられている。
【０００４】
【発明が解決しようとする課題】前述した従来の設置方式は、アンテナの間隔が固定であることから、無線回線のフェージング環境の場所的変動等の影響により、適切な間隔が変化した場合には、互いの受信レベルに相関が生じ良好な伝送品質を実現できないという欠点があった。

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【０００５】
【課題を解決するための手段】本発明の特徴は、上記の課題を解決するため、アンテナ間隔が可変できるアンテナ移動装置、アンテナ間隔をパラメータにして複数の受信アンテナ毎に受信される個別の受信信号の互いの相関値を求める相関計算部を設け、受信する地域毎に最も無相関に近くなるアンテナ間隔で設置するようにしたものである。また、一度間隔を求めた地域においては、車載してある車両位置検出装置と連動させ、車両位置データと共に間隔データをデータベースに記憶しておき、再び、この地域内で受信するときは、車両位置検出装置の車両位置データにより直接データベースから間隔データを得るようにしたものである。
【０００６】本発明では、上記の如く、アンテナ移動装置及び相関計算部を設けることによって場所的変動に適応したアンテナ間隔で設置することができるため、良好な伝送品質で受信することが可能となる。また、車両位置検出装置と連動させることにより、車両位置データと共に間隔データをデータベースに格納しておくことができるため、再びその地域で受信する場合は、迅速にアンテナ移動が行える。
【０００７】
【発明の実施の形態】本発明の一実施例を図１と図２を用いて説明する。本実施例は受信アンテナ２本を用いた場合である。まず、図１に構成ブロック図を示す。無線機端末３には、各アンテナ（各ブランチ）からの受信信号より相関値を計算する相関計算部８、求めた相関値を比較し最小なるものを選択する相関比較部９、アンテナ間隔をパラメータとしてアンテナの移動を制御する間隔制御部１０、アンテナ移動が完了したことを報知するブザー部１１及びディスプレイ表示部１２を設ける。受信アンテナ１と２には、アンテナ移動装置４が接続されており、間隔制御部１０に従って移動を行う。アンテナ移動装置４においては、図３に示すイメージ図のように、移動無線車１５のルーフ上に搭載されている。無線機外部には車両位置データを得るための車両位置検出装置１４と、そのデータと間隔データを格納しておくデータベース１３を設ける。
【０００８】図２は本実施例における動作フローである。まず、電源立ち上げ時等、通信を開始する前に、車両位置検出装置１４により車両位置データを得る（ステップ１００）。次に、このデータに対するアンテナ間隔データが、データベース１３に格納されているかどうかを判断する（ステップ１０１）。データが格納されている場合には、間隔データを間隔制御部１０に送出し、そのデータに対する制御信号をアンテナ移動装置４に送出して、アンテナ１，２を移動させる（ステップ１０

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5）．最後に、ブザー部１１及びディスプレイ表示部１２によりアンテナ移動完了を報知する（ステップ１０６）．

【０００９】次に、間隔データが格納されてない場合には、以下の動作で間隔データを求める．間隔制御部１０には、間隔を移動可能な範囲で間隔データが相関値計算のためのパラメータとして記憶されている．まず、この間隔制御部１０より１つの間隔データに従って、アンテナ移動を行う．次に、受信を開始し、相関計算部において受信高調波及び中間周波部５，６から中間周波信号の信号レベルより相関値を求め（ステップ１０２）、これを相関比較部９に記憶しておく．別の間隔データについても、同様にして相関値を求める．求めた相関値は、相関比較部９において前回記憶していた相関値と比較し（ステップ１０３）、小さい方を選択して記憶する．この動作を全ての範囲について繰り返し行う．ここで、最終的に相関比較部９に記憶した相関値に対するアンテナ間隔は、現地域における最適な間隔である．従って、記憶した相関値に対する間隔データを間隔制御部９から読み出して、車両位置検出装置１４からの車両位置データと共にデータベース１３に記憶しておき（ステップ１０４）、次回からこの地域で通信を行うときには、この間隔データを参照する．最後に、間隔データに従ってアンテナ１及び２を移動し（ステップ１０５）、ブザー部１１及びディスプレイ表示部１２により、完了を報知する（ステップ１０６）．

【００１０】

4

【発明の効果】以上説明したように、本発明によれば、アンテナ間隔をパラメータとして各間隔毎に相関値の計算を行い、相関値が最小となるアンテナ間隔を選択するように構成したため、各地域毎に、無線回線のフェージング環境の場所的変動に応じた最適なアンテナ間隔が得られ、常に最適な符号誤り率を保持することができる．また、このようにして得られたデータは、車両位置検出装置で検出した車両位置データと共に、データベースに記憶するように構成したため、一度相関値を求めた地域では、即座に最適なアンテナ間隔の設定が行え、極めて高速の制御が可能である．したがって、本発明は、特に移動局の運用エリアが、特定の地域内に限定されている自営用移動通信システムにおいて好適である．

【図面の簡単な説明】

【図１】本発明の一実施例の構成を示すブロック図．

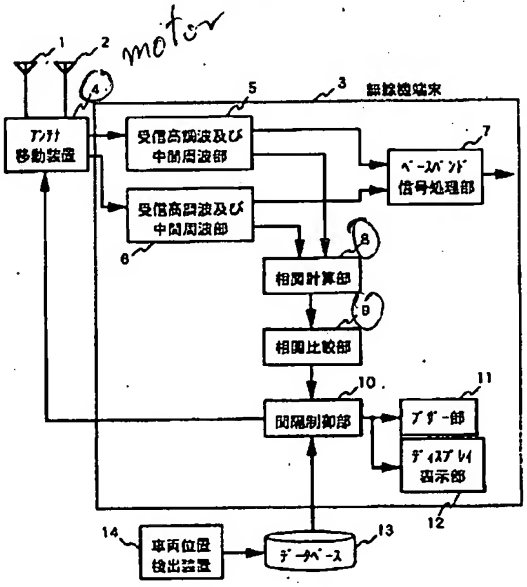
【図２】図１における動作フローチャート．

【図３】アンテナ移動装置を搭載した車両のイメージ図．

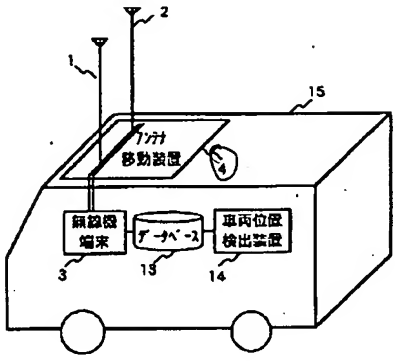
【符号の説明】

１，２…アンテナ、　３…無線機端末、４…アンテナ移動装置、　５，６…受信高調波及び中間周波部、７…ベースバンド信号処理部、　８…相関計算部、９…相関比較部、　１０…間隔制御部、１１…ブザー部、　１２…ディスプレイ表示部、１３…データベース、　１４…車両位置検出装置、１５…移動無線車．

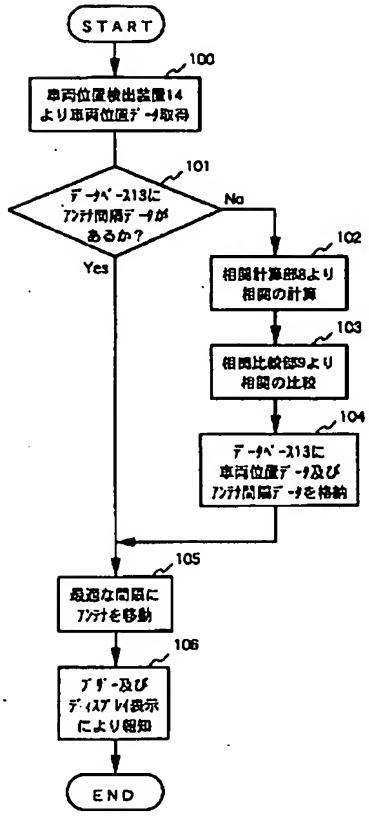
【図１】



【図３】



【図2】


START
100
車両位置検出装置14より車両位置データ取得
101
データベース13にアンテナ間隔データがあるか？
No
Yes
102
相関計算部8より相関の計算
103
相関比較部9より相関の比較
104
データベース13に車両位置データ及びアンテナ間隔データを格納
105
最適な間隔にアンテナを移動
106
ブザー及びディスプレイ表示により報知
END